

Remarks

Favorable reconsideration of this application is requested in view of the following remarks. For the reasons set forth below, Applicant respectfully submits that the claimed invention is allowable over the cited references.

The non-final Office Action dated July 2, 2003, indicated that claims 1-7, 10-14 and 22-23 are rejected under 35 U.S.C. § 102(e) over *Scott* (U.S. Patent No. 6,407,001); claim 8 is rejected under 35 U.S.C. § 103(a) over *Scott* in view of *Chang et al.* (U.S. Patent No. 6,580,072); and claim 9 is rejected under 35 U.S.C. § 103(a) over *Scott* in view of *Birdsley et al.* (U.S. Patent No. 6,210,981).

Applicant respectfully traverses the Section 102(e) rejection because the Office Action fails to present a reference that corresponds to each of the claimed limitations. Claim 1 of the instant invention is directed to a method for focused ion beam gas-assisted etching of a circuit die including, for example, "supplying etch gas" and "while etching the die, supplying sufficient oxygen-containing gas to the die to inhibit corrosion of a portion of the copper in the die being exposed to the etch gas." The Office Action fails to identify where the '001 reference teaches the use of an etch gas. The Office Action relies on a first embodiment that teaches using a focused ion beam (FIB) with an interactive species. This embodiment teaches only two components to the etching process, whereas the instant invention teaches etching using a FIB, an etch gas, and an oxygen-containing gas. The single interactive species does not correspond to both the claimed etch gas and the oxygen-containing gas and the Office Action fails to suggest any proper Section 102 correspondence between the rejected claims and this embodiment of the '001 reference.

The Office Action refers to a second embodiment in which the interactive species is introduced in a two-stage process. The first step of the process is the introduction of a first species such as oxygen with the FIB and then in the second step, a second species such as xenon fluoride is introduced. Contrary to these discrete steps, the instant invention requires that the oxygen-containing gas be introduced while etching the die (both gases present concurrently). The '001 reference fails to teach that the two species are present concurrently. Further, the second species fails to correspond to the claimed etch gas because the second species is introduced to "remove any residual copper material following the patterning." Column 4, lines 22-23. The oxygen-containing gas

of the claimed invention is used specifically to inhibit copper corrosion thereby preventing the complete removal of copper as taught by the '001 reference. Thus, this second species serves the opposite purpose. Both of the embodiments relied upon by the Office Action fail to correspond to the claimed invention. Without complete correspondence to the claimed invention, the Section 102 rejection cannot stand and Applicant requests that the rejection be removed.

With respect to each of the asserted prior art rejections, the '001 reference also fails to teach supplying an oxygen containing gas to inhibit corrosion of copper. Rather, the '001 reference makes no mention of inhibiting copper corrosion. In contrast, the '001 reference teaches that copper is drawn away "without or with minimal disrupted copper material remaining" and that the goal of etching copper in integrated circuit environments is to remove copper while leaving the surrounding dielectric intact as much as possible. See, column 4, lines 6-8 and 38-41. Applicant accordingly requests that the rejections be withdrawn.

The Office Action's assertion at page 4, that using the '001 method in the manner taught in the Specification would inherently result in the inhibition of copper corrosion is both unsupported and plainly incorrect. In order to establish inherency, the extrinsic evidence "must make clear that the missing descriptive matter is *necessarily present in the thing described in the reference*, and that it would be so recognized by persons of ordinary skill." *Continental Can Co. v. Monsanto Co.*, 948 F.2d 1264, 1268, 20 U.S.P.Q.2d 1746, 1749 (Fed. Cir. 1991) (emphasis added). "Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient." *Id.* at 1269, 20 U.S.P.Q.2d at 1749 (quoting *In re Oelrich*, 666 F.2d 578, 581, 212 U.S.P.Q. 323, 326 (C.C.P.A. 1981)). The Office Action fails to provide any of the requisite evidence in support of the inherency assertion. Further, this assertion of inherency fails as the evidence clearly shows that the '001 technique removes the exposed copper instead of preserving the copper and protecting it from corrosion as discussed above. Accordingly, the inherency argument is unsupported, incorrect and therefore cannot be maintained.

With particular respect to the rejection of claim 5, Applicant traverses the rejection because the Office Action fails to address the claimed invention "as a whole" by

ignoring Applicant's discovery. The instant Specification teaches that "it has been discovered that maintaining an oxygen gas supply in the chamber to provide a chamber pressure of between about 5-10 micro Torr sufficiently inhibits the corrosion of copper in a typical integrated circuit die." *See*, page 6, lines 3-6. The MPEP indicates that discovering the source or cause of a problem is part of the "as a whole" inquiry: "[A] patentable invention may lie in the discovery of the source of a problem even though the remedy may be obvious once the source of the problem is identified." *See*, MPEP § 2141.02. Further, the Office Action alleges that the '001 range (1×10^{-5} to 1×10^{-4} Torr) corresponds to the claimed range of 5×10^{-6} to 1×10^{-5} Torr. To maintain this rejection, the MPEP requires that the prior art range be disclosed with sufficient specificity. *See*, MPEP § 2131.03. The pressure range of the '001 reference varies by a power of ten without any explanation as to why or when certain pressures would be desirable; thus, the '001 range is overly broad. As discussed above the range required by claim 5 is the result of a specific discovery and is used to inhibit copper corrosion. The Office Action fails to show proper correspondence to the limitations of claim 5; therefore the rejection should be withdrawn.

The Office Action further fails to present the requisite evidence for each of the inherency assertions and evidence of correspondence between the '001 reference and the limitations of various other dependent claims. Regarding claim 7, as discussed above, the '001 reference fails to teach supplying an etch gas or the inhibition of copper corrosion. With respect to claim 10, the '001 reference makes no use of a gettering agent, and rather, maintains the xenon fluoride in the chamber to eliminate any remaining copper instead of removing the fluoride gas with a gettering agent. With respect to claims 11-13, the Office Action fails to show where the '001 reference teaches detecting processing conditions, such as a level of halide in the chamber, and responding to the detected parameters before proceeding with the etching. This processing flexibility fails to correspond to the cited '001 discussion of a debug cycle. The failure of the Office Action to present evidence of correspondence of the claimed invention to the '001 teachings renders the Section 102 rejection improper. Applicant accordingly requests that the rejection be withdrawn.

Applicant respectfully traverses the Section 103(a) rejection of claim 8 because the proposed combination teaches away from the claimed invention. The Office Action suggests at the top of page 7 that the '001 reference be combined with the '072 reference "for the purpose of eliminating the step of supplying an oxygen containing gas to copper to inhibit corrosion." Such a suggestion directly contradicts the requirement that the claims be examined "as a whole" and is untenable. Instead of showing correspondence to the claimed limitations, the Office Action attempts to circumvent the claim limitations. This disregard for the requirements of a *prima facie* rejection is improper and the rejection should be withdrawn.

Moreover, the Office Action fails to present evidence of motivation to make the proposed combination. The cited portion of the '072 reference teaches that the reactive gases used to enhance the etch, e.g., bromine, chlorine and iodine, would severely damage neighboring copper structures. As discussed above, the instant invention teaches supplying an oxygen containing gas in order to inhibit or prevent corrosion to the exposed copper. One skilled in the art would not be motivated to combine the reactive etch gases of the '072 reference (damaging copper structures) with the '001 method (removing most or all exposed copper) to achieve the claimed inhibiting of copper corrosion. The suggestion to combine the '072 teachings with the '001 teachings is improper and the rejection should be removed.

Applicant respectfully traverses the Section 103 rejection of claim 9 because relied upon U.S. Patent Number 6,210,981 would not be prior art pursuant to 35 U.S.C. § 103(c). As set forth in MPEP § 706.02(I)(1), effective November 29, 1999, subject matter which was prior art under former 35 U.S.C. § 103 via 35 U.S.C. § 102(e) is now disqualified as prior art against the claimed invention if that subject matter and the claimed invention "were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person." U.S. Patent Number 6,210,981 is, and has been over the entire relevant time period when the instant invention was made, owned by the same entity, Advanced Micro Devices ("AMD"), or subject to an obligation of assignment to the same entity who is the assignee of the instant application. These common assignments are evidenced by the instant assignment recorded at reel/frame number 012208/0962 and the cover page of U.S. Patent Number

6,210,981. The Office Action acknowledges that the '001 reference fails to teach each of the claimed limitations and without a showing of complete correspondence to the claimed invention, the Section '103 rejection cannot stand. Applicant requests that the rejection of claim 9 be withdrawn.

In view of the remarks above, Applicant believes that each of the rejections has been overcome and the application is in condition for allowance. Should there be any remaining issues that could be readily addressed over the telephone, the Examiner is encouraged to contact the undersigned at (651) 686-6633.

Respectfully submitted,

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